

05/27/99



jc586 U.S. PTO

Patent Application Transmittal

(only for new nonprovisional applications under 37 C.F.R. 1.53(b))

Correspondence Address:
FROMMER LAWRENCE & HAUG LLP
745 FIFTH AVENUE
NEW YORK, NEW YORK 10151
TEL: (212) 588-0800
FAX: (212) 588-0500

jc490 U.S. PTO

09/320702



05/27/99

Date: May 27, 1999

Attorney Docket No.: 450100-4893

ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Sir:

With reference to the filing in the United States Patent and Trademark Office
of an application for patent in the name(s) of:

Tomoyuki HANAI, Yasutomo NISHINA, Masahiko SATO, Motoki KATO

entitled:

TRANSMIT DEVICE AND METHOD THEREOF, RECORD/PLAY DEVICE AND METHOD THEREOF AS
WELL AS RECORDING SYSTEM AND MEDIA

The following are enclosed:

- X Specification (29 pages)
- X 13 Sheet(s) of Drawings
- X 22 Claim(s) (including 8 independent claim(s))
- This application contains a multiple dependent claim

- X Our check for \$ 1,186.00, calculated on the basis of the claims as
amended by any enclosed preliminary amendment as follows:

Basic Fee, \$760.00 (\$380.00)	\$ 760.00
Number of Claims in excess of 20 at \$18.00 (\$9.00) each: 2	36.00
Number of Independent Claims in excess of 3 at \$78.00 (\$39.00) each: 5	390.00
Multiple Dependent Claim Fee at \$260.00 (\$130.00)	-0-
Total Filing Fee	\$ 1,186.00
Assignment Recording Fee \$40.00	-0-

- X Oath or Declaration and Power of Attorney
 - X New signed X unsigned
 - Copy from a prior application (37 C.F.R. 1.63(d))

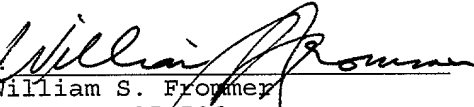
- X Certified copy of each of the following application(s) to substantiate
the claim(s) for priority made in the Declaration:

<u>Application No.</u>	<u>Filed</u>	<u>In</u>
10-149536	29 May 1998	Japan

Please charge any additional fees required for the filing of this
application or credit any overpayment to Deposit Account No. 50-0320.

Respectfully submitted,

FROMMER LAWRENCE & HAUG LLP
Attorneys for Applicants

By: 
William S. Frommer
Reg. No. 25,506

FROMMER LAWRENCE & HAUG LLP

745 FIFTH AVENUE NEW YORK, NEW YORK 10151

WILLIAM S. FROMMER
WILLIAM F. LAWRENCE
EDGAR H. HAUG
MATTHEW K. RYAN
BARRY S. WHITE
THOMAS J. KOWALSKI
JOHN R. LANE
DENNIS M. SMID *
DANIEL G. BROWN
BARBARA Z. MORRISSEY

May 27, 1999

Assistant Commissioner for Patents
Washington, D.C. 20231

Re: U.S. Patent Application
Applicants: Tomoyuki HANAI, Yasutomo NISHINA, Masahiko SATO,
Motoki KATO
Our Ref.: 450100-4893

A. THOMAS S. SAFFORD
MARILYN MATTHES BROGAN
STEVEN M. AMUNDSON
JEROME ROSENSTOCK
RAYMOND R. WITTEKIND, PH.D.
Of Counsel

JAMES K. STRONSKI
GORDON KESSLER
MARK W. RUSSELL *
MARC ASPERAS
BRUNO POLITO
ADITYA KRISHNAN *
JULIE BOWKER
GRACE L. PAN *
JEFFREY A. HOVDEN
JOE H. SHALLENBURGER
CHRISTIAN M. SMOLIZZA *
Admitted to a Bar
other than New York

Dear Sir:

Enclosed are papers constituting the above patent application which is being filed under 37 C.F.R. 1.53 without a signed Declaration. Please accord a filing date and a serial number to such application and inform the undersigned thereof so that a signed Declaration and the surcharge required by 37 C.F.R. 1.16(e) may be duly filed.

Please address all correspondence to:

William S. Frommer, Esq.
FROMMER LAWRENCE & HAUG LLP
745 Fifth Avenue
New York, New York 10151

Respectfully,



William S. Frommer
Reg. No. 25,306
Attorney for Applicants
Enclosures

PATENT
450100-4893

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

TITLE: TRANSMIT DEVICE AND METHOD THEREOF, RECORD/PLAY
DEVICE AND METHOD THEREOF AS WELL AS RECORDING
SYSTEM AND MEDIA

INVENTORS: Tomoyuki HANAI, Yasutomo NISHINA, Masahiko SATO,
Motoki KATO

William S. Frommer
Registration No. 25,506
FROMMER LAWRENCE & HAUG LLP
745 Fifth Avenue
New York, New York 10151
Tel. (212) 588-0800

TRANSMIT DEVICE AND METHOD THEREOF, RECORD/PLAY DEVICE AND
METHOD THEREOF AS WELL AS RECORDING SYSTEM AND MEDIA

BACKGROUND

1. Field of the Invention

The present invention relates to a transmit device and method, a record/play device and method, record system as well as a media and relates in particular to a transmit device and method, record/play device and method as well as a record system for transmitting the data quantity for a program from the digital broadcast, detecting the available capacity of the record media on the receive side, comparing both transmit data quantity and receive side available capacity and selecting the optimal record media for recording the data of that program.

2. Background of the Invention

Digital satellite broadcasting has recently become capable of providing programs on more than 100 channels. When the available channels become this numerous, selecting a desired channel becomes an inconvenient task for the viewer. Whereupon EPG (Electronic Program Guide) data is transmitted separately from the actual program information and the viewer can then select the desired channel based on the EPG.

In order for the viewer to be able to select the desired

program from among the many available programs, the EPG data contains a table comprised of basic data such as broadcast station (channel) information, daily program broadcast information, program start time information and program length, etc. In addition to this information, information for the respective program attribute information descriptors such as the program title information, detailed program information (plot) is also sent. This transmitted information is acquired by the receiver and the EPG data corresponding to the data for a particular channel can be displayed on a monitor.

In contrast to analog broadcasts where the overall amount of data of the broadcast program is determined in proportion to the program broadcast time length in a fixed method, in digital broadcasts, the overall amount of program data is further determined by the proportion of transmission bit rate to the program broadcast time length.

Accordingly, in digital broadcasts it is difficult to know beforehand how much available record media will be required in order to receive the program. Consequently, selecting the optimal record media to record the program data is difficult.

In view of the above situation, this invention is intended to allow the program data quantity for the digital

broadcast to be sent and the optimal record media to be selected by the receiver based on this program data quantity.

SUMMARY OF THE INVENTION

In consideration of the foregoing, it is therefore an object of the present invention to provide a transmit device which resolves the above mentioned problem. Another object of the present invention is to provide a transmit method which resolves the above mentioned problem. A further object of the present invention is to provide a transmission media which resolves the above mentioned problem. A still further object of the present invention is to provide a record device which resolves the above mentioned problem. A yet further object of the present invention is to provide a record method which resolves the above mentioned problem. Still another object of the present invention is to provide a record media which resolves the above mentioned problem. Yet another object of the present invention is to provide a recording system which resolves the above mentioned problem. Other and further objects, features and advantages of the invention will appear more fully from the subsequent description.

The object of the present invention to provide a record device includes EPG data generation means, supplemental means, and transmission means. The EPG data generation means is for

generating EPG data. The supplemental means is for generating supplemental information including information indicating the program data quantity and add this information to the EPG data. The transmission means multiplexes the program data and the EPG data added with supplemental information and transmits this multiplexed information as a digital signal.

The object of the present invention to provide a transmit method contains a generation step, a supplement step and a transmit step. The generation step generates EPG data. The supplement step generates supplemental information indicating the program data quantity and adds this information to the EPG data. The transmit step multiplexes the program data and the EPG data to which the supplemental information was added and transmits this multiplexed information as a digital signal.

The object of the present invention to provide a record device contains receive means and control means. The receive means is for receiving the program data transmitted as a digital signal and receiving the EPG data to which supplemental information was added containing information indicating the program data quantity. The control means extracts the supplemental information from the EPG data and based on the supplemental information and the capacity of the

record media, controls the selection of the record media for recording the program data.

The object of the present invention to provide a record method contains a receive step, an extraction step, and a selection step. The receive step receives the program data transmitted as a digital signal and receives the EPG data to which the supplemental information was added containing information indicating the program data quantity. The extraction step extracts the supplemental information from the EPG data. The selection step selects the record media for recording the program data based on the capacity of the record media.

The object of the present invention to provide a recording system contains a transmit device and a record device. The transmit device contains EPG data generation means, supplemental means and transmit means. The EPG data generation means generates the EPG data. The supplemental means generates supplemental information including information indicating the program data quantity and adds this supplemental information to the EPG data. The transmit means multiplexes the program data and the EPG data to which the supplemental information was added and transmits this multiplexed information as a digital signal. The record device contains receive means and control means. The receive

means receives the program data and the EPG data. The control means extracts the supplemental information from the EPG data and controls the selection of the record media for recording the program data based on the supplemental information and the capacity of the record media.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the configuration of the transmit device adapted for this invention.

Fig. 2 is a block diagram showing the configuration of the receive device adapted for this invention.

Fig. 3 is a block diagram showing the configuration of the record/play device adapted for this invention.

Fig. 4 is a block diagram showing the configuration of the record controller 91 of Fig. 3.

Fig. 5 is a drawing showing the remote controller 61 of Fig. 2.

Fig. 6 is a flowchart describing the record reserve process for the control CPU 108.

Fig. 7 is a flowchart continuing from Fig. 6.

Fig. 8 is a drawings displaying the flow of screen images for the record reserve process shown on the monitor 62.

Fig. 9 shows other screen images of the process flow continuing from Fig. 8.

Fig. 10 is a drawing showing sample library data.

Fig. 11 is a drawing showing typical record media category settings.

Fig. 12 is a flowchart describing another record reserve process for the control CPU 108.

Fig. 13 are images of another display flow of record reserve images displayed on the monitor 62.

Fig. 14 is a block diagram showing another configuration of the record/play device adapted for this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereafter, an embodiment of this invention is described while referring to the accompanying drawings. A block diagram showing the configuration of transmit device comprising the transmit/receive system of this invention is shown in Fig. 1. The program data to be broadcast, including audio data and video data is generated in a program editor 11. A main system processor 12 supplies the program data received from the program editor 11 to an encoder 13 and also generates and reference blocks and time information to a system information processor 15, an operation system processor 16, an EPG system processor 17 and a multiplexer 14, etc. The program data supplied from the program editor 11 by way of the main system processor 12 is encoded in a format

such as MPEG format and output to the multiprocessor 14.

The system information processor 15 generates the system information and controls the multiplexing operation in the multiplexer 14. The operation system processor 16 processes the operator input signals from the keyboard and mouse (not shown in drawing) and sends an output to the main processor when necessary.

The EPG generator 18 generates the EPG data and outputs this data to an editor 19. The editor 19 adds data quantity information showing the data quantity of that program to the EPG data. The EPG system processor 17 synchronizes with the signal supplied from the main system processor 12, processes EPG data supplied from the editor 19 and outputs this data to the multiprocessor 14. The multiprocessor 14 synthesizes the EPG data supplied from the EPG system processor 17 with the program data supplied from the encoder 13 and outputs the synthesized data to a satellite (not shown in the drawing) as a transport stream.

Fig. 2 shows a sample configuration of the receive device for receiving the data transmitted by way of the satellite from a receiver 1 shown in Fig. 1. The receive device 31 receives by way of a tuner 41, the RF carrier transmitted by the satellite and outputs the received signal to a demodulator 42. This demodulator 42 demodulates the

signal supplied from the tuner 41 and outputs the demodulated signal to a demultiplexer 43. The demultiplexer 43 besides extracting the audio and video data comprising the program data from the data input from the demodulator 42, also extracts the EPG data. The demultiplexer 43 respectively supplies the audio data to an audio decoder 46, the video data to a video decoder 45 and the EPG data to the control CPU44. The demultiplexer 43 also supplies stream data containing video data, audio data and EPG data, along with identification data for discriminating the audio data and the video data to a record device 71 which is connected to the demultiplexer 43.

An audio decoder 46 decodes the audio data that was input and outputs the decoded audio for instance to a VCR (video cassette recorder) 63 or a monitor 62 connected to the receive device 31. A video decoder 45 decodes the video data and output the decoded video to a display processor 47.

An OSD (On Screen Display) controller 48 is controlled by means of the control CPU44, OSD (On Screen Display) data is created to make redundant video data and output to the display processor 47. Operating under the control of the display processor 47, the video data supplied by the video decoder 45 is synthesized as needed with the OSD data supplied from the OSD controller 48 and output to the monitor 62.

An EPG data memory 50 stores in necessary amounts, the

EPG data the control CPU44 has received from the demultiplexer 43. A program memory 51 stores the programs required to run the various types of processing of the control CPU44. A work memory 52 stores as needed the programs and data required for the control CPU44 to run the various processes. An operation unit 53 receives signals from the buttons and switches (not shown in drawing) installed on the chassis of the receive unit 31 or input by infrared signal from the remote controller 53 (hereafter remote control) and outputs these detected signals to the control CPU44.

A record device 71 records the stream data from the demultiplexer 43.

The configuration of the record device 71 is shown in Fig. 3. When a record manager 91 receives the stream data, and identification data for the audio data and stream data, the record manager 91 demultiplexes (or isolates) the video data, audio data and EPG data from the stream data and also detects the data quantity information from the EPG data. The record manager 91 monitors the capacity of the record media 92-1 through 92-N and library data containing this quantity information is stored internally in a memory 113 (Fig. 4). The record manager 91 selects the most ideal record media for recording from among the record media 92-1 through 92-n based on the library data and the data quantity information and the

results of the selection are externally output as needed to a monitor 62. The record manager 91 then records the video data and audio data in the selected record media from among the record media 92-1 through 92-n according to the inputs entered by the user based on the monitor display.

A block diagram of the manager 91 is shown in Fig. 4. A stream buffer 101 receives the transport stream supplied from the demultiplexer 43 of the receive device 31, temporarily stores the transport stream and then outputs it to the bus controller 102 and the demultiplexer 103. The bus controller 102, besides controlling the transmission of the various signal on the buses to which it has made connection, also supplies the data input from the stream buffer 101 to the specified record media from among the record media 92-1 through 92-n as well as to the controller CPU 108. The demultiplexer 103, besides extracting the audio data and the video data from the data input from the stream buffer 101, also extracts the EPG data. The audio data and video data are supplied to a video/audio buffer 104 and the EPG data to the SI (Service Information) buffer 111. After the video/audio buffer 104 under the control of the decode CPU106 stores the video and audio data that was input, the video and audio data is supplied to the video/audio decoder 105. The video/audio decoder 105 decodes the video data that was

supplied and supplies the decoded data to a display processor 107.

Under the control of the control CPU 108, the display processor 107 synthesizes the OSD data supplied from an OSD controller 109 with the video data that was supplied and outputs the data to an external monitor 62 according to the signal supplied from the receive device 31 by way of the AV switch 110.

After the SI buffer 111 temporarily stores the EPG data supplied from the demultiplexer 103, the SI buffer 111 then outputs the EPG data to the control CPU 108. An EPG data memory 112 stores the EPG data the control CPU 108 has received from the SI buffer 111. A library data memory 113 stores required information by means of the record media 92-1 through 92-n managed by the control CPU 108.

Fig. 5 is a drawing showing the functions of a remote control 61. The remote controller 61 contains cursor keys 131-1 to 131-4 for moving the cursor keys up and down and left and right on the monitor screen, a button 132 for displaying the EPG on the monitor screen, an OK button 133 for making the respective settings, a button 134 for scheduling recording of the program, a button 135 for playing back the recorded data, a button 136 for deleting the recorded data, a button 137 for making the program category settings related

later, and a button 138 to perform the library display related later. When the user clicks one of these buttons, processing corresponding to that button are performed in the record device 71.

The process for scheduling the recording of program data by means of the control CPU 108 in the record manager 91 of the record device 71 is next explained while referring to the flowcharts in Fig. 6 and Fig. 7. This processing can also be executed on the OSD controller 109. The record media 1 - 3 listed hereafter, indicate record media numbers set to correspond to the record media 92-1 through 92-N. First, in step S1, the control CPU 108 is in standby until the "Record Schedule" button 134 on the remote control 61 is clicked by the user. When the "Record Schedule" button 134 is clicked by the user, the control CPU 108 then receives the record program command by way of the AV switch 110, and the processing proceeds to step S2. In step S2, the control CPU 108 loads the data quantity for the program specified for recording from the EPG data memory 112. Actually the exact same operation and effect can be obtained if the user directly operates the button on an operating unit 53 having the same buttons as the remote control 61 and this approach is explained next using the remote control 61 as the operating medium.

In step S3, the control CPU 108 decides if data

expressing the overall data capacity of the program (hereafter called overall data capacity) is present or not inside the program data that was loaded. If determined that the overall data capacity is present, the process proceeds to step S4 where the control CPU 108 sets this overall data capacity as data Dt for the program specified for recording in step S1.

However, if for instance the program is a live broadcast, then the EPG data generator 18 of the transmit device 1 cannot beforehand accurately determine a fixed quantity representing the overall data capacity of the program to transmit. In such a case, the EPG data generator 18 outputs an average bit rate to the encoder 13 during encoding, instead of the overall data capacity of the program and supplies this average bit rate to the control CPU 108 by way of the receive device 31 from the multiplexer 14 via satellite, the stream buffer 101 and the bus controller 102. Accordingly, when determined in step S4 that an overall data capacity is not present inside the data of the program specified for recording, the process proceeds to step S5 where the control CPU 108 detects the average bit rate data for the program specified for recording in step S1 and in step S6 decides whether or not average bit rate data is present.

When determined in step S6 that average bit rate data

is present, the process proceeds to step S7, the control CPU 108 loads this average bit rate data Ra from the EPG data that was transmitted and further, in step S8, loads the data length Lp for the program specified for recording in step S1. Still further, in step S9, calculates the sum of the data length Lp and this average bit rate data Ra and sets the results of this calculation as the program data quantity Dt.

After completion of steps S4 and S9, the control CPU 108 detects in step S10, the respective remaining storage capacity of the record media 92-1 through 92-N from the library data stored in the library data memory 113. The control CPU 108 then determines in step S11 whether or not an optimal record media is present. Restated, the control CPU 108 determines whether or not the maximum capacity remaining in the record media 92-1 through 92-N is a sufficient capacity to record the program data of the program specified for recording.

In step S11, upon determining that an optimal record media is present, the process proceeds to step S12 where the control CPU 108 controls the OSD controller 109 and the information of this optical record media (in this case, record media 2) is generated, and output to the monitor 62. The monitor 62 displays in image such as shown on the screen b of Fig. 8, in the display space provided in the lower part

of screen b of Fig. 8 (EPG is shown on the left side).

When decided in step S11 that an optimal record media is not present, the process proceeds to step S13 and the OSD controller 109 under the control of the control CPU 108, generates information indicating that an optimal record media is not present and outputs this information to the monitor 62. The control CPU 108 displays a message such as in screen c of Fig. 8, on the display space provided on the lower part of the screen a of Fig. 8 (EPG is displayed on left side) on the monitor 62 and stands by for a command from the user ordering deletion of the recorded program.

When a display such as on screen c of Fig 8 appears, the user clicks the cursor key 131-1 or the cursor key 131-4 on the remote control 61 and moves the cursor left and right on the screen above "OK" or "CANCEL" and clears the screen by clicking the "OK" button 133. The user next clicks the "Library display" button 138 on the remote control 61 and transmits the command signal to the control CPU 108 by way of the AV switch 110. The control CPU 108 controls the OSD controller 109 according to the command from the user and displays a library data image as shown in Fig. 10. At this point, the user clicks the cursor key 131-1 or the cursor key 132-2 in order to assure recording space for the program data that is to be recorded by moving the cursor on the screen to

a program that can be deleted and clicking the "Delete" key button 136. By deleting the selected program data in this way, a command signal can be sent to the control CPU 108 by way of the AV switch 110.

In other words, the user selects program data that can be deleted in the available record program data consisting of program titles, record time, record day, data quantity and channel as shown in Fig. 10. Restated, the user moves the cursor on the screen to a point with program data that can be deleted (news A in the current case) by clicking the cursor key 131-1 or the cursor key 131-2 and then clicking the "Delete" button 136 at that position.

Upon receiving a command from the user as in step S13 to delete a record program, the process proceeds to step S14 and the control CPU 108 deletes program data specified for deletion by the user from among the program data stored in the library data memory 113. As a result, in the library data (corresponding to program data stored in the library data memory 113), the available storage capacity will increase by 300MB which is equal to the data quantity of the news A. In other words, an "Available recording capacity" of 1 GB (in this case, record media 2) corresponding to the "Record Media No." is displayed. However, in the "Data quantity" for the record programs displayed on the lower part of the same figure,

the capacities were respectively 300MB, 150MB and 450MB so that the original available capacity increased to 400MB (1GB - (300MB + 150MB+450MB) = 100MB) after deleting the data described above. Thus for example, when a data quantity D_t was set as 200MB in step S4, this deletion will allow recording space to be obtained for new program data. Further, The control CPU 108 next returns to step S10 and performs the same processing repeatedly until (Yes is decided in step S11) recording space is obtained for the next program data that the user currently wants to record. When the decision in step S11 is a YES, the process proceeds to step S12 and the subsequent processing is performed.

After completion of the processing in step S12, the operation proceeds to step S15 of the flowchart of Fig. 7 continuing from the flowchart of Fig. 6, and the control CPU 108 stands by until a reply from the user is received in response to the screen image as shown on screen b of Fig. 8. The user here moves the cursor up or down to the "YES" or the "NO" position on an image display as shown on screen b of Fig. 8 by clicking the cursor key 131-1 or 131-2 and then clicking the "OK" button 133 for one of these positions. When the user has made a reply, the process proceeds to step S16 and the control CPU 108 decides from the "YES" or "NO" command received on the screen in response to the b screen of Fig. 8.

The control CPU 108 proceeds to step S17 when a "YES" was received from the user in step S16, and the control CPU 108 then executes the processing to schedule (or reserve) the program data as specified in step S1 per record media 2. The control CPU 108 next displays an image such as on the screen d of Fig. 8 on the monitor 62 by controlling the OSD controller 109. The user clicks the cursor keys 131-3 or the cursor key 131-4 of the remote control 61 to move the cursor left or right to the "OK" or the "CANCEL" button in response to the display message shown on screen d of Fig. 8, and clicks the "OK" button which clears the screen. By this action, the user thus confirms the end of the data scheduling of the program specified in step S1 in Fig. 6.

When the control CPU 108 determines that a "NO" command was received from the user, the process proceeds to step S18. Here, the control CPU 108 controls the OSD controller 109 to display an image as shown in screen e of Fig. 8 and stands by for a command from among the record media 92-1 through 92-N from the user according to the screen display. The user then moves the cursor to another record media number (in this case record media 1) from among the record media 92-1 through 92-N of the program data specified in step S1 of Fig. 6 whose recording is desired, by clicking the cursor keys 131-1 or 131-2 on an image such as shown in screen e of Fig. 8, and

the user then clicks the "OK" button 133 at that position.

When the user specifies another record media from among the record media 92-1 through 92-N in step S18, the process then proceeds to step S19 and the control CPU 108 determines whether or not there is available capacity in the record media (in this case, record media 1) re-specified by the user. When determined that there is available capacity in a record media specified again by the user, the process proceeds to step S17 and the control CPU 108 schedules the program data specified in step S1 of Fig. 6 for the record media (in this case, record media 1) specified in step S18.

More specifically, the OSD controller 109 under the control of the control CPU 108 displays an image such as shown on the screen f of Fig. 9. The user, in response to the screen f of Fig. 9, moves the cursor up or down to the "YES" or the "NO" position on an image display as shown on screen f of Fig. 9 by clicking the cursor key 131-1 or 131-2 and then clicking the "OK" button 133 for one of these positions. If the user selects "NO", then the control CPU 108 again displays an image shown as previously related for screen e of Fig. 8 and from hereon, the same image is repeatedly displayed.

When the user selects a "YES" from screen f in Fig. 9, the OSD controller 109 under the control of the control CPU 108 displays an image such as shown on screen h of Fig. 9.

The user in response to the image display on screen h of Fig. 9, clicks the cursor key 131-3 or the cursor key 131-4 of the remote control 61 to move the cursor right or left to the "OK" or the "CANCEL" on the screen and then clicks the OK button 133 clearing the screen.

When the control CPU 108 determines in step S19 that there is not sufficient available capacity in the record media re-specified in step S18, the process proceeds to step S20 and the OSD controller 109 functions to display an image such as shown on screen g of Fig. 9 on the monitor 62. The user in response to the image display on screen g of Fig. 9, clicks the cursor key 131-3 or the cursor key 131-4 of the remote control 61 to move the cursor right or left to the "OK" or the "CANCEL" on the screen and then clicks the OK button 133 clearing the screen. Afterwards, the user just the same as for processing in response to step S13 of Fig. 6, clicks the "Library display" button 138 to display library data for the record media (in this case, record media 1) specified in step S18.

Next, in order to obtain recording space on which to record the desired program data, the user clicks the cursor key 131-1 or cursor key 131-2 and further moving the cursor on to the program to be erased, the user then clicks the "Delete" button 136. When the "Delete" button 136 is clicked,

a command signal is transmitted by way of the AV switch 110, to the control CPU 108 to select deletion of the program data.

When the control CPU 108 receives this command from the user, the same processing as in step S14 of Fig. 6 is performed on the re-specified record media of step S18. Afterwards, the control CPU 108 returns to step S19, and repeatedly performs the same processing until the recording space for the program data specified for recording in step S1 of Fig. 6 is finally obtained (determined as a YES in step S19) inside the re-specified record media in step S18. The control CPU 108 next proceeds to step S17 when a YES is determined in step S19, and performs the subsequent processing.

When determined in step S6 of Fig. 6 that there is no average bit rate, the process proceeds to step S22 and the control CPU 108 schedules recording in response to manual operation by the user on the optimal media from among the record media 92-1 through 92-N. In other words, the user checks the record media 92-1 through 92-N one by one for available capacity and designates the optimal record media. After completion of the processing of step S22, the process proceeds to step S17 of Fig 7 and the control CPU 108 performs the subsequent processing.

After completion of the processing of step S17 in Fig. 7, the control CPU 108 terminates all processing.

However, record program data quantity setting is performed in addition to making settings for the record program category transmitted by the EPG from the transmit side to the record media 92-1 through 92-N and based on these category settings, the control CPU 108 is further able select an ideal record media. The embodiment is explained as follows. The transmit/receive system of this embodiment contains a transmit device 1, a receive device 31, a record device 71, a record manager 91 as well as a remote control 61. These components were previously described so an explanation is omitted here.

The operation of the record manager 91 inside the record device 71 is explained next. Library data such as shown in Fig. 10 stored in the library data memory 113 of the record device 71, contains the respective items "Record media No." and "Category" respectively for the record media 92-1 through 92-N. The user clicks the "Library display" button 138 of the remote control 61 to display these "Record media No." and "Category" items on the screen as shown in Fig. 11 and then operates the cursor keys 131-1 through 131-4 to move the cursor to the desired setting position and then clicks the "OK" button 133 to transmit a command for a category setting. In response to this user operation, the "Record media No." and "Category" items are both linked and registered in the library data memory

113 under the control of the control CPU 108 of the record device 71.

The record scheduling process for program data by means of the control CPU 108 of the record manager 91 of record device 71 is next explained while referring to the flowchart of Fig. 12 (This processing can also be executed on the OSD controller 109). The control CPU 108 performs processing identical to that of steps S1 and S2 in Fig. 6. Afterwards, in step S43 the control CPU 108 loads the EPG data from the program data specified in step S41 and decides whether or not category data is present. When the control CPU 108 decides that category data is present, the process proceeds to step S44 and the control CPU 108 matches this category data with the record media number of the record media.

The program specified in step S41 is scheduled for recording (dubbing) in the subsequently related step S58 so that this specified program is thus recorded in the record media 92-1 through 92-N corresponding to that category during recording. The category data loaded (read out) in step S42 may be an item other than that stored in the library data memory 113, but that possibility is disregarded in this flowchart. If indeed an item other than that stored in the library data memory 113 is read out (loaded) then the processing of the flowcharts of Fig. 6 and Fig. 7 in the previous embodiment

is performed and the user may for instance make manual settings in step S18 of Fig. 7 while referring to screen e of Fig 8.

In steps S45 through S51, the control CPU 108 executes the same processing as in steps S5 through S11 in Fig. 6, for the program data that was specified in step S41. In step S52, the control CPU 108 searches according to the matching category of step S44, the record media 92-1 through 92-N of the library data stored in the library data memory 113 for remaining recording capacity for record media specified for the program designated in step S41. Based on this remaining recording capacity, the control CPU 108 determines in step S53 whether or not an optimal record media is present for the program category from among the record media 92-1 through 92-N.

In other words, when the record media specified in step S44 from among record media 92-1 through 92-N has sufficient capacity to record the program specified in step S41, the control CPU 108 determines that the media specified in step S44 is the optimal record media. However, when the media specified in step S44 does not have sufficient available record capacity, then the control CPU 108 determines that an optimal record media is not present.

In step S53, when the control CPU 108 determines that an optimal record media is present, the process proceeds to

step S54. Here, under control of the OSD controller 109, information is generated to show an optimal record media (in this case, record media 2) is present, and output to the monitor 62. The control CPU 108 causes an image as shown in screen b of Fig. 13 to be displayed in a display space provided in the lower part of screen a (The EPG is displayed on the left.) of Fig. 13.

In step S53, when the control CPU 108 determines that an optimal record media is not present, the operation proceeds to step S55 and under control of the OSD controller 109, information is generated indicating that an optimal record media is not present and output to the monitor 62. The control CPU 108 causes an image as shown in screen c of Fig. 13 to be displayed in a display space provided in the lower part of screen a (The EPG is displayed on the left.) of Fig. 13. The control CPU 108 then stands by just the same as in step S13 of Fig. 6, until a command is received to delete the recorded program.

In step S55, upon receiving a command from a user to delete a recorded program, the control CPU 108 deletes program data specified for deletion from among program data stored in the library data memory 13 just as performed in step S14 of Fig. 6. As a result, in the library data (corresponding to program data stored in the library data memory 113), the

available storage capacity will increase by 300MB which is equal to the data quantity of the news A. In other words, an "Available recording capacity" of 1 GB (in this case, record media 2) corresponding to the "Record Media No." is displayed. However, in the "Data quantity" for each recorded program displayed in the lower part of the same figure, the capacities were respectively 300MB, 150MB and 450MB so that the original available capacity increased to 400MB (1GB - (300MB + 150MB+450MB) = 100MB) after deleting the data as described above. Thus for example, when a data quantity Dt was set as 200MB in step S46, the above described deletion will therefore allow recording space to be obtained for new program data. Further, the control CPU 108 next returns to step S52 and performs the same processing repeatedly until (Yes is decided in step S53) recording space is obtained for the next program data the user currently wants to record.

In step S48 when the control CPU 108 determines that average bit rate data is not present, the process proceeds to step S57 and the same processing as in step 22 of Fig. 6 is executed.

After completion of the processing in steps S54 and S57, the process proceeds to step S58 and the control CPU 108 schedules recording (dubbing) of the program data specified in step S41 of Fig. 12, onto the record media corresponding

to the record media number (in this case, record media 2) specified in step S44. The OSD controller 109 then displays an image as shown in screen d of Fig. 13 on the monitor 62. The user then moves the cursor on the screen to the "OK" or the "CANCEL" position in response to the image displayed on screen d of Fig. 13 and clicks the "OK" button, clearing the screen. By clicking the "OK" button, the user confirms that scheduling of recording (dubbing) for the program data specified in step S41 of Fig. 12 is complete.

After completion of the processing of step S58, the control CPU 108 terminates all processing.

Both of the two embodiments showed the record manager 91 connected to the respective record media by means of an internal bus, however this invention may also use an arrangement such as shown in Fig. 14 in which the record manager 91 connects to the respective record media by means of an IEEE1394 format bus 151 utilized as an external bus. In Fig. 14, except for the IEEE1394 format bus 151, the structure is identical to Fig. 3 so an explanation is omitted here.

In this invention, the media supplied to the user having the computer program for executing the above described processing, besides information recording media such as CD-ROM or magnetic disks may also be a transmission media

operating by means of a network such the Internet or digital
satellite, etc.

WHAT IS CLAIMED IS:

1. A transmit device comprising:

EPG data generation means for generating EPG data;

supplementing means to generate supplemental information containing information showing the program data quantity and append said supplemental information to said EPG data; and

transmit means to multiplex program data with EPG data added with said supplemental information and transmit this multiplexed information as a digital signal.

2. A transmit device as claimed in claim 1, wherein said supplementing means adds the information indicating the data quantity of said program as average bit rate data.

3. A transmit device as claimed in claim 1, wherein said supplementing means further contains information indicating the program category.

4. A transmit method comprising:

a generating step to generate EPG data;

a supplementing step to generate supplemental information containing information indicating the data quantity of the program and adding this supplemental information to said EPG data; and

a transmit step to multiplex the program data with the EPG data added with said supplemental information and

transmit this multiplexed information as a digital signal.

5. A transmit method as claimed in claim 4, wherein said supplementing step adds the information indicating the data quantity of said program as average bit rate data.

6. A transmit method as claimed in claim 4, wherein said supplementing information further contains information indicating the program category.

7. A program to supply a record media, wherein said program comprises:

a generation step to generate EPG data;

a supplementing step to generate supplemental information containing information indicating the data quantity of the program and to add said supplemental information to said EPG data; and

a transmit step to multiplex the program data with the EPG data added with said supplemental information and transmit this multiplexed information as a digital signal.

8. A record media as claimed in claim 7, wherein said supplementing step adds the information indicating the data quantity of said program as average bit rate data.

9. A record media as claimed in claim 7, wherein said supplementing information further contains information indicating the program category.

10. A record device comprising:

receive means to receive EPG data added with supplemental information containing information indicating the data quantity of said program, and program data transmitted as a digital signal; and

control means to extract said supplemental information from said EPG data, and control selection of said record media for recording said program data based on the quantity of said record media.

11. A record device as claimed in claim 10, wherein said receive means receives EPG added with an average bit rate data as information indicating the data quantity of said program, said control means calculates the data quantity of said program from said average bit rate data, and controls selection of a record media to record said program data based on said program data quantity and the capacity of said record media.

12. A record device as claimed in claim 10, wherein said control means has supplemental information further indicating the program category, and said control means controls selection of a record media to record said program data based on information indicating said program category and on category information set for said record media.

13. A record device as claimed in claim 10, wherein said record media is comprised of one unit.

14. A record device as claimed in claim 10, wherein said record device is connected by way of a bus and external said record media.

15. A record device as claimed in claim 15, wherein said bus is an IEEE1394 configuration bus. —

16. A record method comprising:

a receive step to receive EPG data added with supplemental information containing information indicating the data quantity of said program, and program data transmitted as a digital signal;

an extraction step to extract said supplemental information from said EPG data; and

a selection step to select said record media on which to record said program data based on said supplemental information and on the capacity of the record media.

17. A record method as claimed in claim 16, wherein in said receive step, EPG data added with average bit rate data as information expressing the data quantity of said program is received; and

in said selection step, the data quantity of said program is calculated from said average bit rate data, and a record media selected on which to record said program data based on said program data quantity and on the capacity of the record media.

18. A record method as claimed in claim 16, wherein in said selection step, said supplemental information further contains information indicating the program category, and still further, the record media on which to record said program data is selected based on information indicating said program category and on category information set for said record media.

19. A media for providing a program, wherein said program comprises:

a receive step to receive EPG data added with supplemental information containing information indicating the data quantity of said program, and program data transmitted as a digital signal;

an extraction step to extract said supplemental information from said EPG data; and

a selection step to select said record media on which to record said program data based on said supplemental information and on the capacity of the record media.

20. A media for providing a program, wherein said receive step receives EPG data added with average bit rate data as information expressing the data quantity of said program; and

in said selection step the data quantity of said program is calculated from said average bit rate data, and a record

media selected on which to record said program data based on said program data quantity and on the capacity of the record media.

21. A media as claimed in claim 19, wherein in said selection step, said supplemental information further contains information indicating the program category, and still further, the record media on which to record said program data is selected based on information indicating said program category and on category information set for said record media.

22. A recording system comprising
a transmit method including:
generating means to generate EPG data;
supplementing means to generate supplemental
information containing information indicating the data
quantity of the program and adding this supplemental
information to said EPG data; and

transmit means to multiplex the program data with the
EPG data added with said supplemental information and
transmit this multiplexed information as a digital signal,
and

a record method including:
receive means to receive EPG data and program data; and
control means to extract said supplemental information

from said EPG data and to control selection of a record media to record said program data based on information indicating the capacity of said record media and on the supplemental information.

ABSTRACT

A transmit device and method, a record/play device and method, a record system as well as a media allowing selection of the ideal record media by the receiver. The EPG data generator of a transmit device generates an EPG (Electronic Program Guide) showing the scheduled transmission of the program to be broadcast. An editor generates supplemental information containing information indicating the program data quantity, adds the supplemental information to the EPG and a multiplexer transmits the EPG added with the supplemental information.

FIG.1

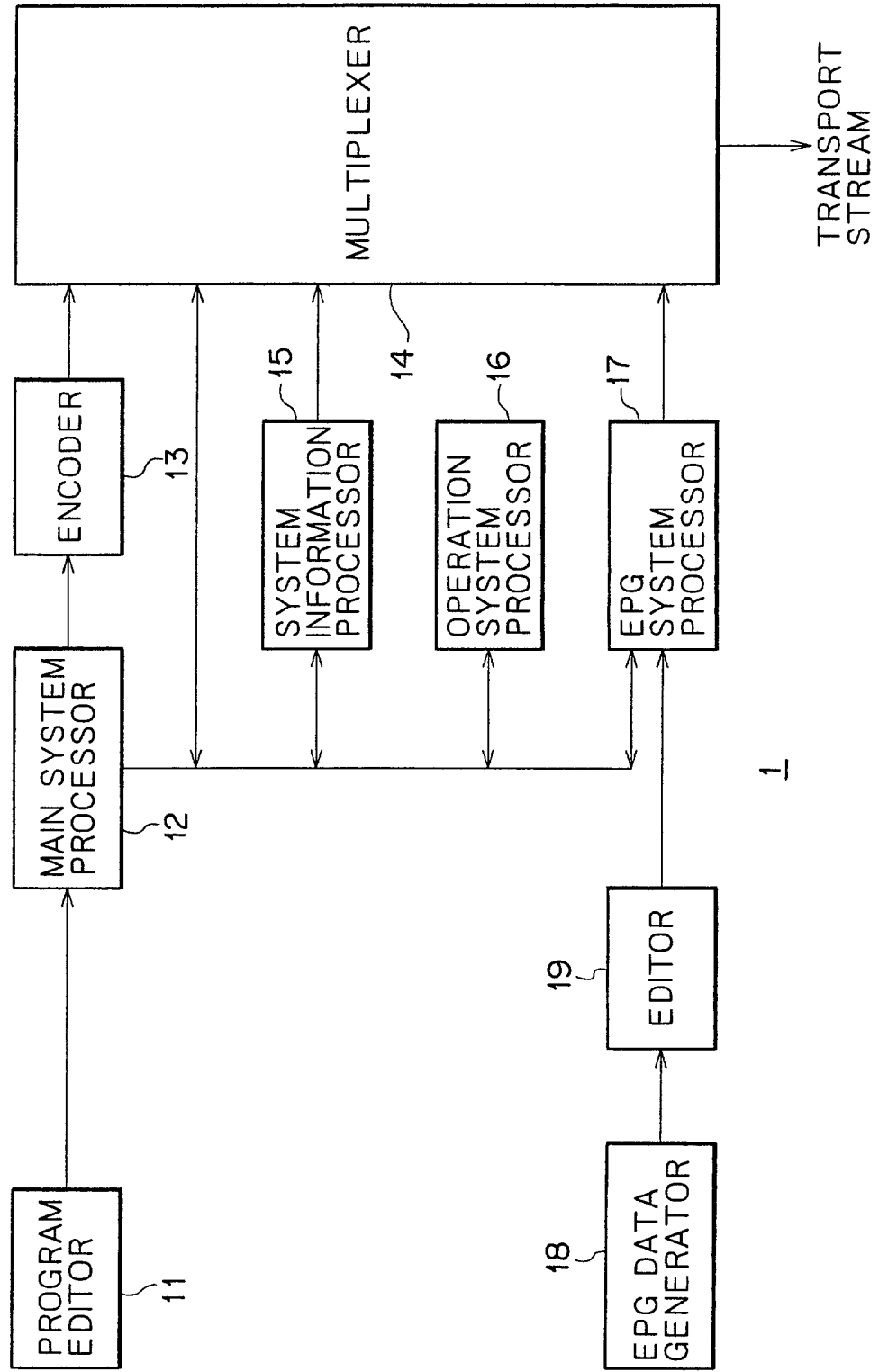


FIG. 2

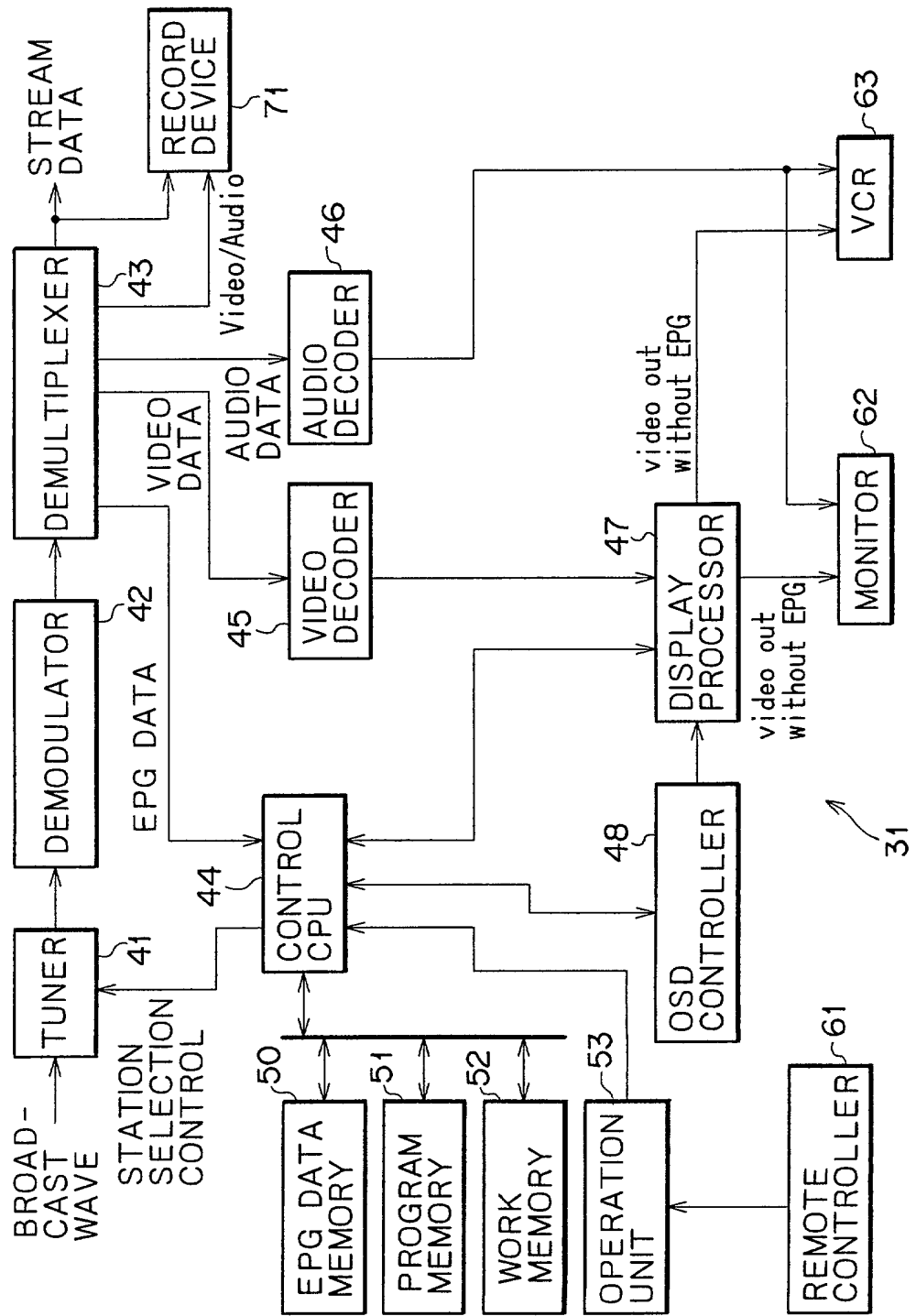


FIG. 3

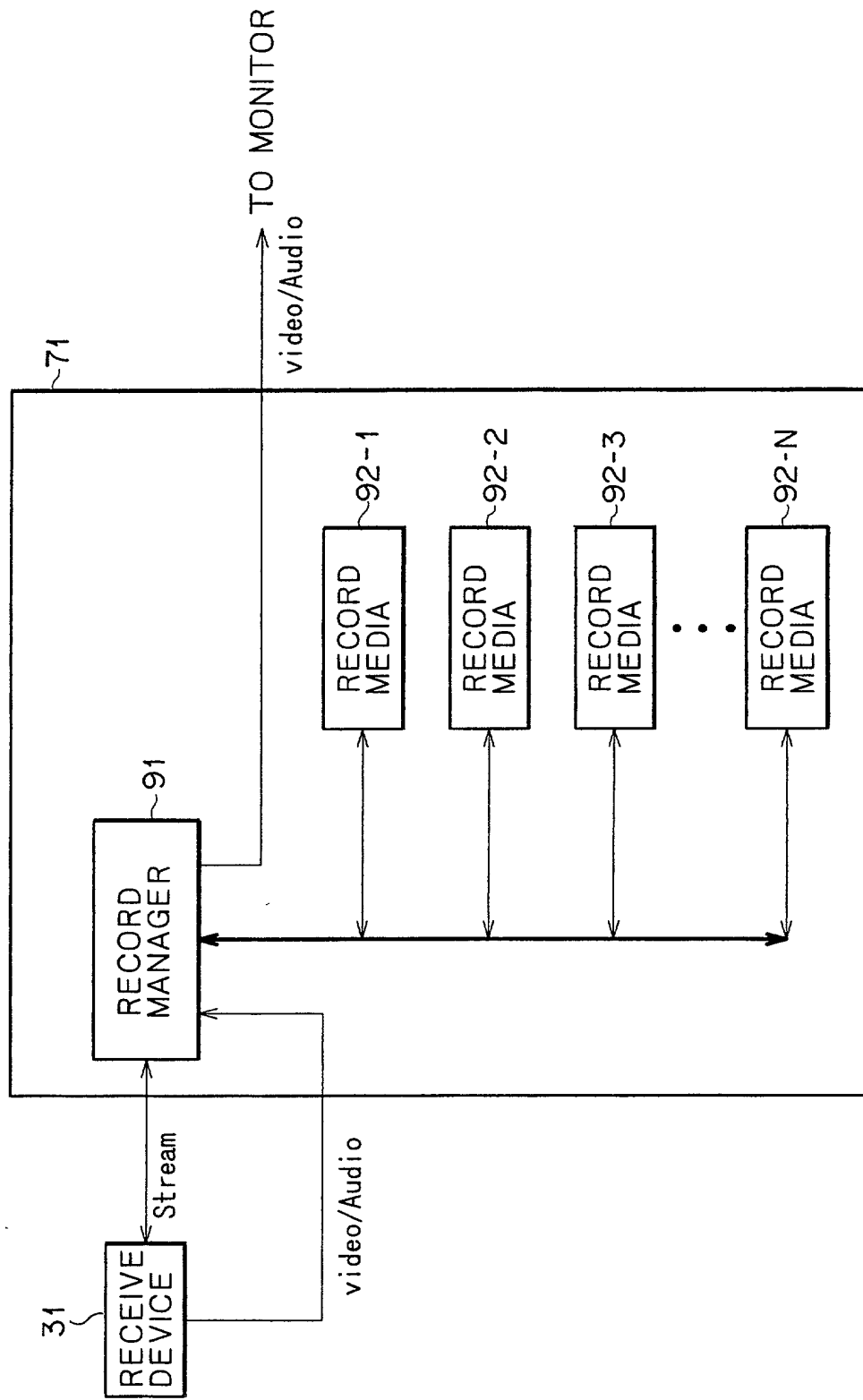


FIG. 4

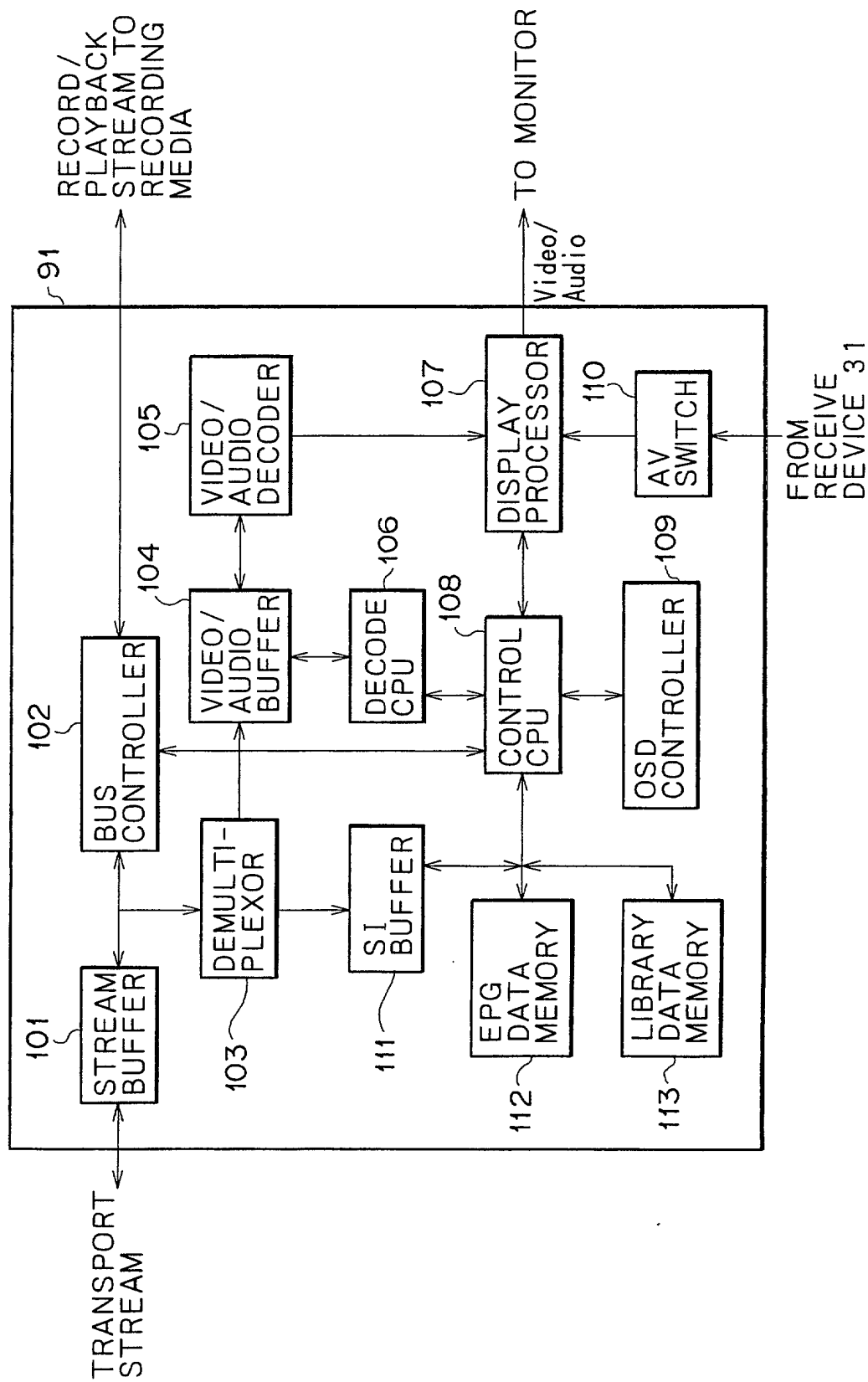


FIG. 5

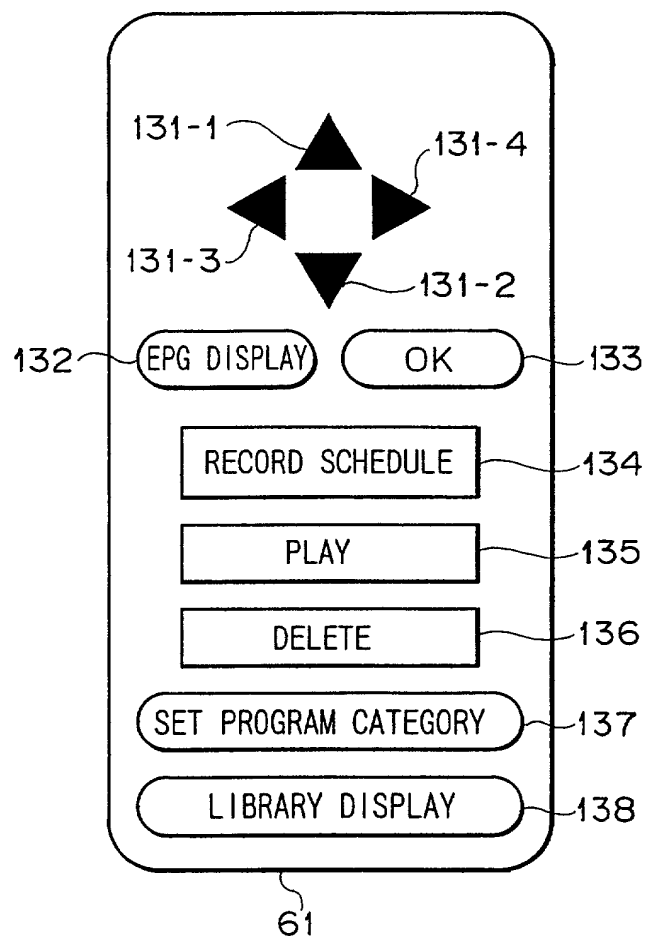


FIG. 6

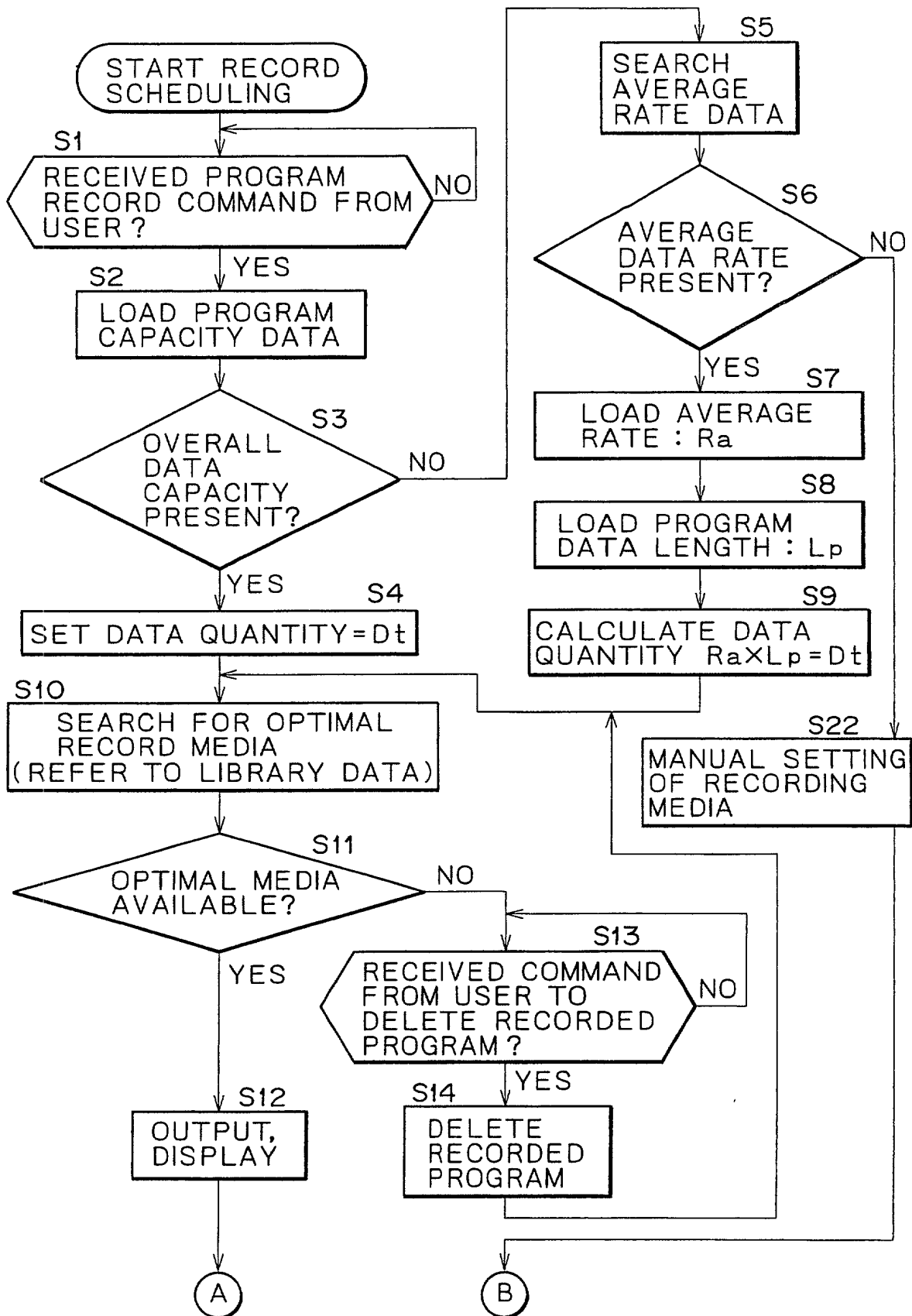


FIG. 7

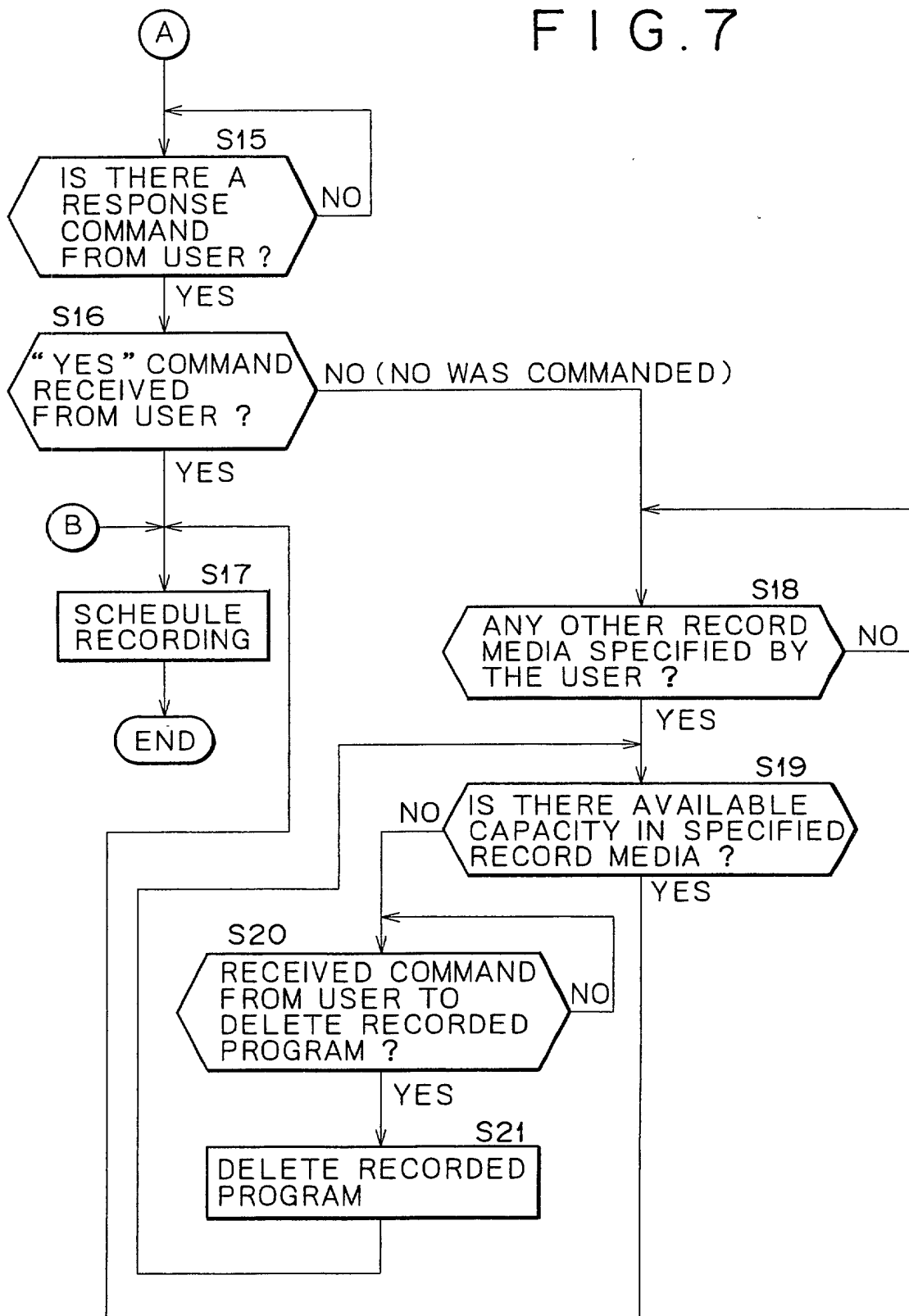


FIG. 8

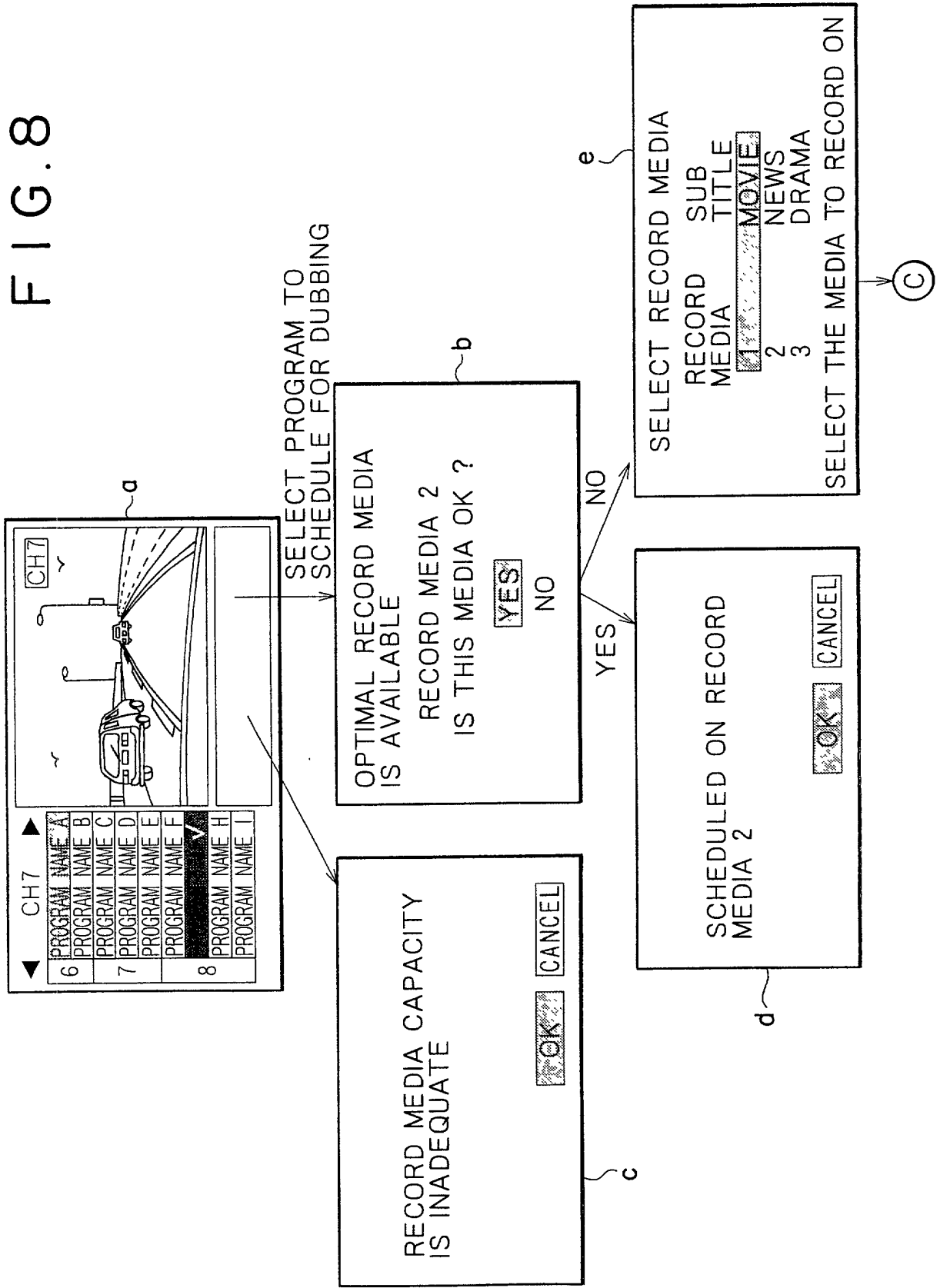


FIG. 9

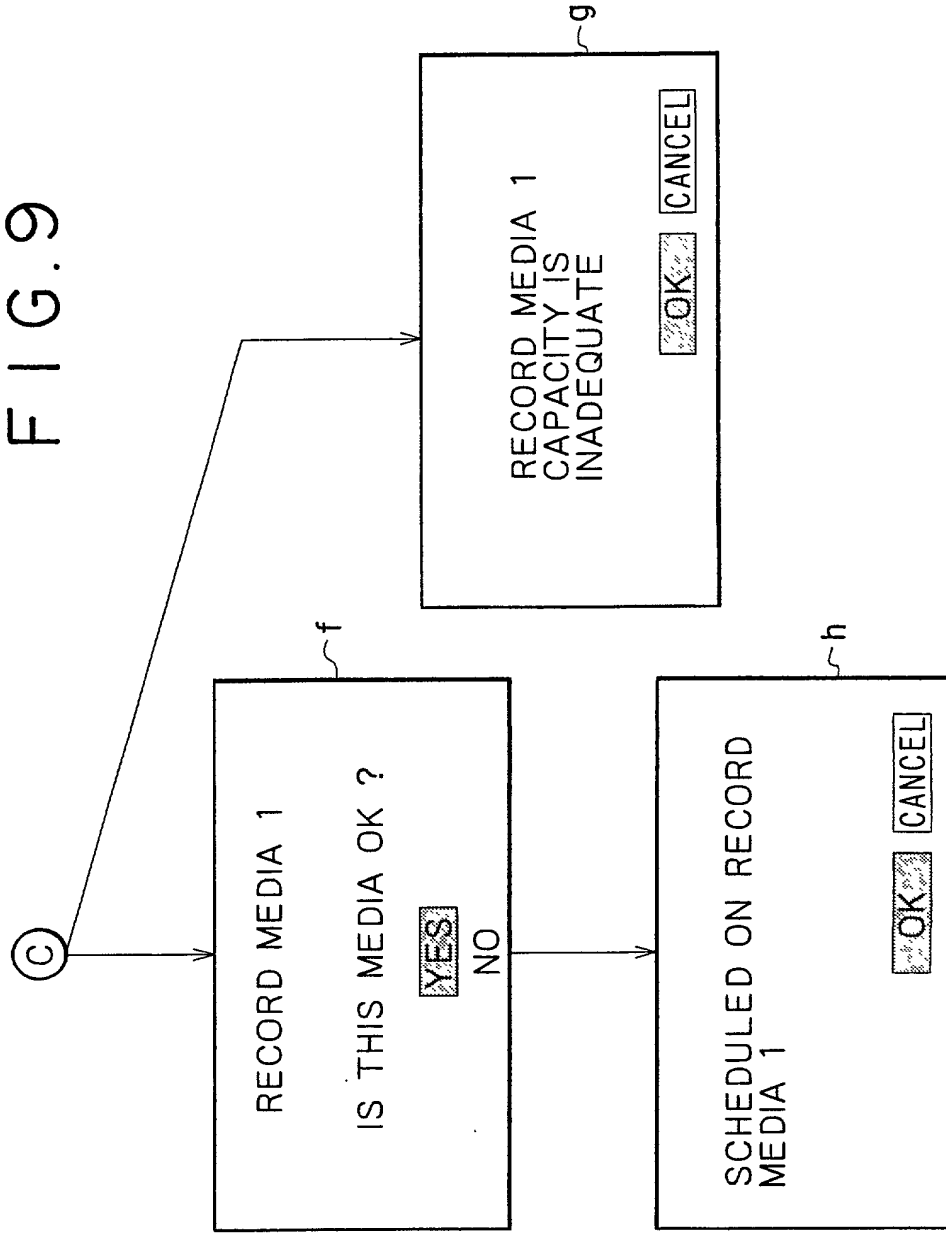


FIG.10

RECORD MEDIA NO.:2
 RECORDING CAPACITY:1GB
 CATEGORY:NEWS
 RECORDING ITEMS:

PROGRAM TITLE	RECORDING TIME	RECORDING DAY	DATA QUANTITY	CHANNEL
NEWS A	19HOURS	FEB 20	300MB	BS5
NEWS B	30 MINUTES	FEB 21	150MB	10
NEWS C	1 HOUR	MAR 1	450MB	3

SELECT THE PROGRAM FOR PLAY OR DELETE
 AND PRESS THE PLAY/DELETE KEY

FIG.11

RECORD MEDIA CATEGORY SETTING

RECORD MEDIA NO.	CATEGORY
1	MOVIE
2	NEWS
3	DRAMA

SELECT RECORD MEDIA WITH THE↑↓KEYS
 SELECT THE CATEGORY WITH THE←→KEYS
 AND PRESS OK

FIG.12

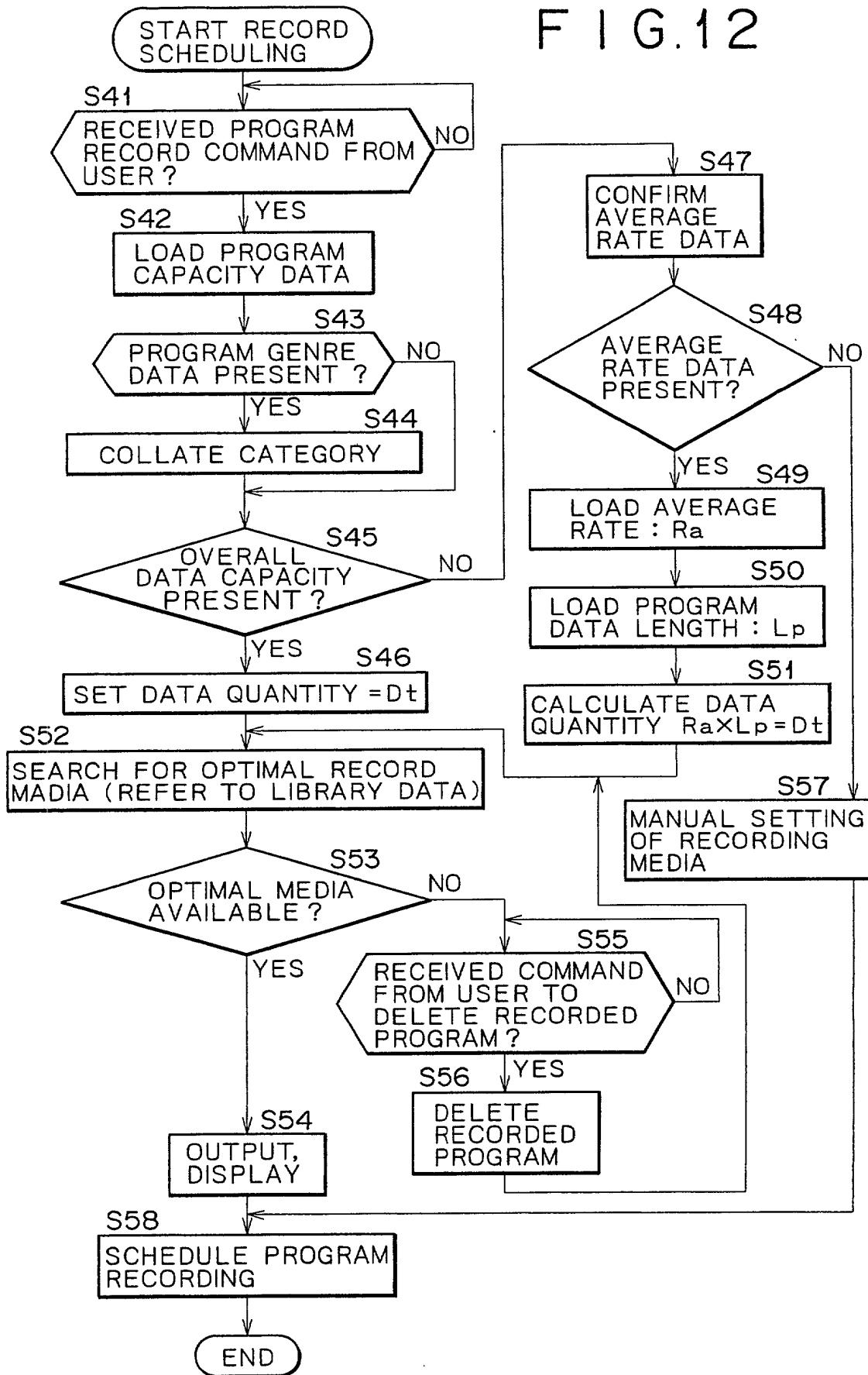


FIG. 13

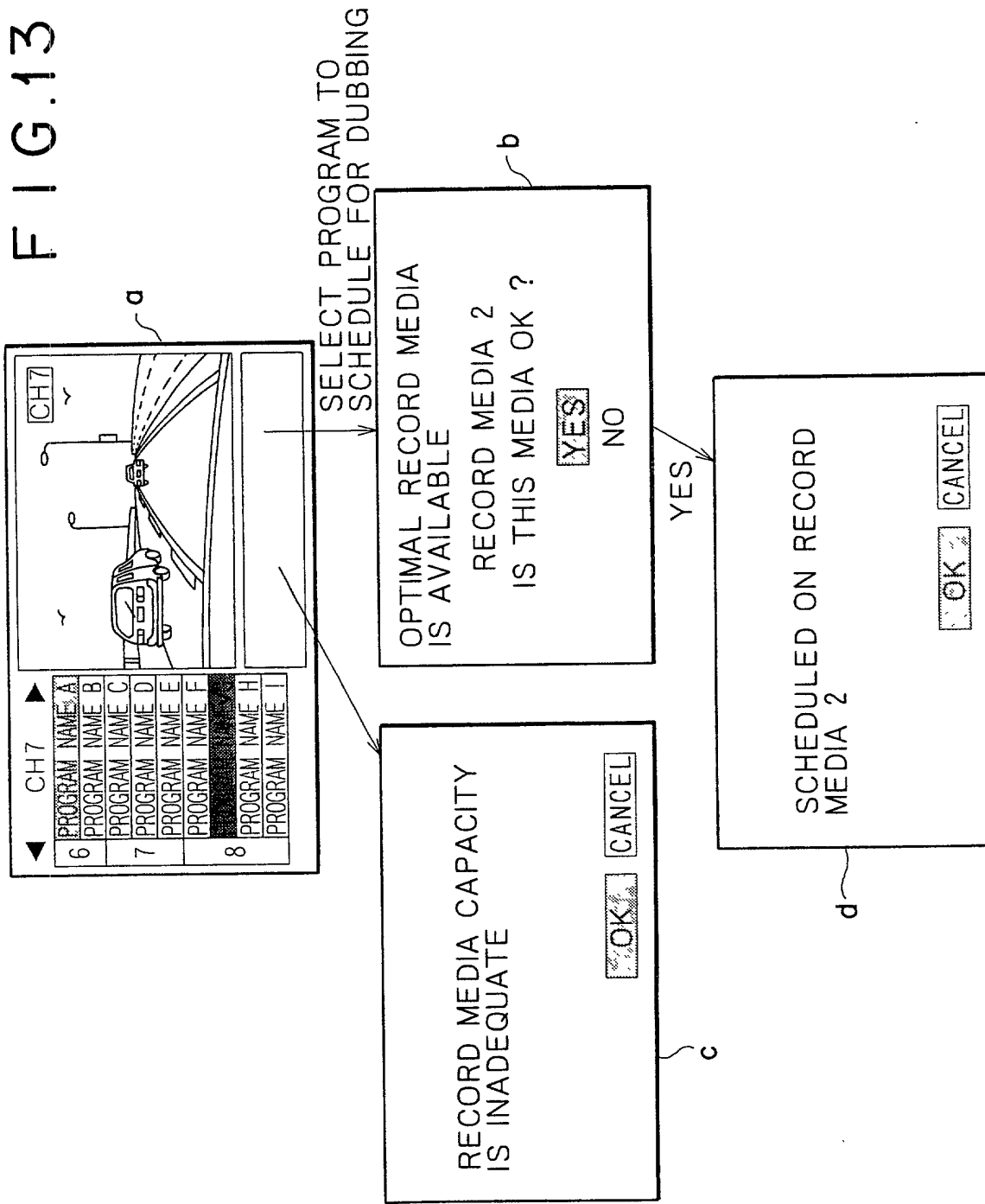
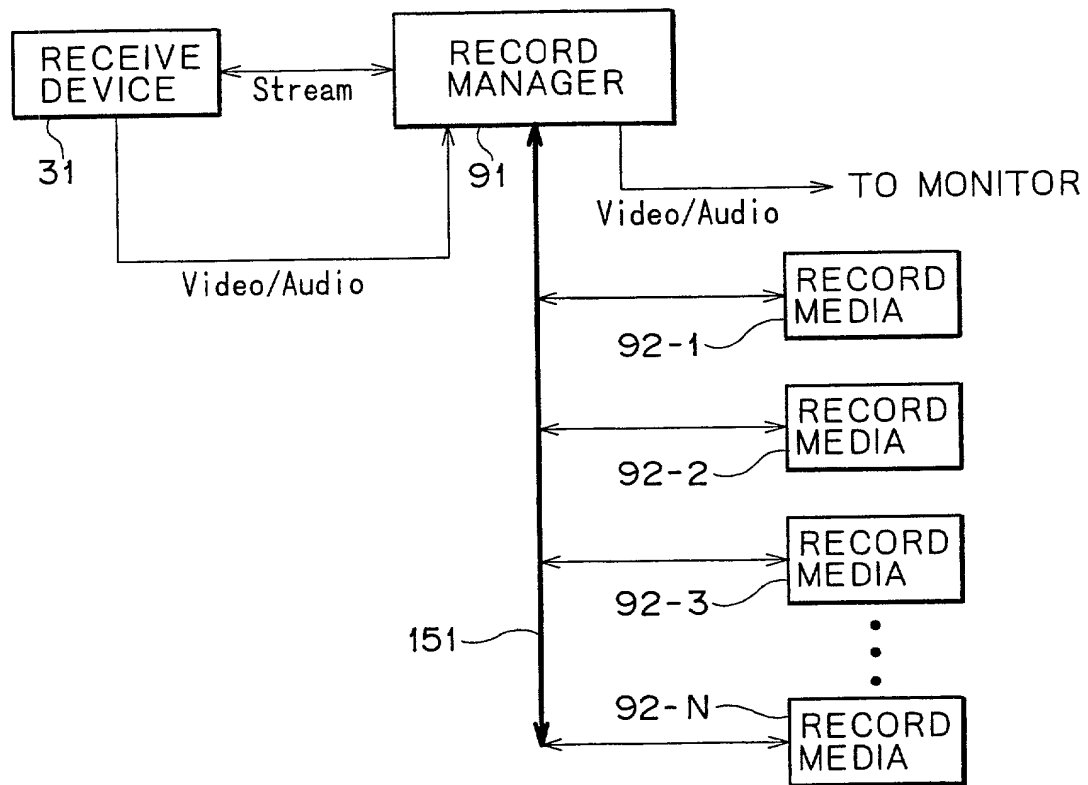


FIG. 14



DECLARATION FOR PATENT APPLICATION (JOINT OR SOLE)

(Under 37 CFR § 1.63; with Power of Attorney)

FROMMER LAWRENCE & HAUG LLP

FLH File No. 450100-4893

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention ENTITLED:

**TRANSMIT DEVICE AND METHOD THEREOF, RECORD/PLAY DEVICE AND METHOD THEREOF AS WELL AS
RECORDING SYSTEM AND MEDIA**

the specification of which

X is attached hereto.

_____ was filed on _____ as Application Serial No. _____,

with amendment(s) through _____ (if applicable, give dates).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s) [List additional applications on separate page]: Priority Claimed:

Number:
10-149536

Country:
Japan

Filed (Day/Month/Year):
29 May 1998

Yes No
X

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Prior U.S. Application(s) [List additional applications on separate page]:

App'n. Ser. Number: Filed (Day/Month/Year): Status (patented, pending, abandoned):

I hereby appoint WILLIAM S. FROMMER, Registration No. 25,506, and DENNIS M. SMID, Registration No. 34,930 or their duly appointed associate, my attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to file continuation and divisional applications thereof, to receive the Patent, and to transact all business in the Patent and Trademark Office and in the Courts in connection therewith, and specify that all communications about the application are to be directed to the following correspondence address:

WILLIAM S. FROMMER, Esq.
c/o FROMMER LAWRENCE & HAUG LLP
745 Fifth Avenue
New York, New York 10151

Direct all telephone calls to:
(212) 588-0800
to the attention of:
WILLIAM S. FROMMER

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

INVENTOR(S):

Signature: _____ Date: _____

Full name of sole or first inventor: Tomoyuki HANAI
Residence: Kanagawa, Japan
Citizenship: Japan

Signature: _____ Date: _____

Full name of 2nd joint inventor (if any): Yasutomo NISHINA
Residence: Chiba, Japan
Citizenship: Japan

Signature: _____ Date: _____

Full name of 3rd joint inventor (if any): Masahiko SATO
Residence: Tokyo, Japan
Citizenship: Japan

[Similarly list additional inventors on separate page]

Post Office Address(es) of inventor(s):

[if all inventors have the same post office address]

Sony Corporation
7-35 Kitashinagawa 6-chome
Shinagawa-Ku, Tokyo 141, Japan

Note: In order to qualify for reduced fees available to Small Entities, each inventor and any other individual or entity having rights to the invention must also sign an appropriate separate "Verified Statement (Declaration) Claiming [or Supporting a Claim by Another for] Small Entity Status" form [e.g. for Independent Inventor, Small Business Concern, Nonprofit Organization, individual Non-Inventor].

Note: A post office address must be provided for each inventor.

ADDITIONAL INVENTORS

Signature: _____ Date: _____
 Full name of 4th joint inventor (if any): Motoki KATO
 Residence: Kanagawa, Japan
 Citizenship: Japan

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209
2210
2211
2212
2213
2214
2215
2216
2217
2218
2219
2220